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10/718,837	11/21/2003	Balaji Raghothaman	873.0134.U1(US)	1329

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HARRINGTON & SMITH, PC
4 RESEARCH DRIVE
SHELTON, CT 06484-6212

EXAMINER	
PASIA, REDENTOR M	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/718,837	RAGHOTHAMAN ET AL.	
	Examiner	Art Unit	
	Redentor M. Pasia	2616	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-23* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-23* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *21 November 2003* is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *11/03/2005, 11/21/2003*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Drawings

The drawings are objected to as failing to comply with 37 CFR 1.84(p)(5) because they do not include the following reference sign(s) mentioned in the description: Adder 38 in Par. 0022. Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Claim Objections

Claims 1-10 and 20 objected to because of the following informalities:

As to claim 1, "*...defining a second size*M_2*...*" should be corrected to "*...defining a second size* M_2*...*"

As to claim 20, the last 2 lines of the claim includes claim 21. (21. The transmitter of claim 20, wherein at least one additional subpacket comprises only parity bits.). The examiner suggests either to omit this line or include this line in future amendments.

Appropriate correction is required.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 1-4, 7, 9-12, 20 are rejected under 35 U.S.C. 102(e) as being anticipated by Walton et al. (US 678341 B2; hereinafter Walton).

As to claim 1, Walton shows a method for transmitting a digital packet (abstract) comprising: encoding (212) a plurality of N systematic bits across time into an encoded

packet of size M bits; determining a quality of at least a first channel from a feedback circuit (figures 1 and 2, CSI; col. 6 line 63 to col. 7, line 2); dividing (120) the encoded packet into a first transmission packet defining a first size M_1 bits that includes N_1 of the N systematic bits and a second transmission packet defining a second size M_2 bits that includes N_2 of the N systematic bits (col. 7, lines 31-39; Table 1), wherein at least one of M_1 and N_1 is based on the determined quality of the first channel (Table 1, SNR column; col. 6, line 39 to col. 7, line 2); and transmitting in parallel the first transmission packet from a first antenna at a first rate over the first channel and the second transmission packet from a second antenna at a second rate over a second channel (Figure 1-3; col. 7, lines 33-44), wherein M, M_1, M_2,N, N_1 and N_2 are all non-zero integers (Table 1; M, M_1, M_2 are the # of Coded Bits/Symbol (modulation symbols) and N, N_1, N_2 are the number of Information Bits/Symbol); except one of N_1 and N_2 may be zero (The examiner interprets this claim limitation as having only either N1 or N2 present which suggests that only one antenna is in use for transmission. In a case, where N1 or N2 is either zero, it suggests that the demultiplexer in the only outputs one subpacket (same as the packet) and the packet is transmitted onto only one of the antennas. Col. 7, lines 33-39, shows that the demultiplexer demultiplexes the received modulation symbols into a number of (N_T) modulation symbol streams, one stream for each antenna used to transmit the modulation symbols.), M is greater than N (Table 1), M is at least equal to M_1+M_2), and N is at least equal to N_1+N_2. (col. 7, lines 31-39; modulation symbols are "demultiplexed" into modulation symbol streams, one stream for each antenna used;

col. 6, lines 21-31, Table 1 shows that the information bits are modulated into coded bits. Hence, coded bits (modulation symbol stream) contain the information bits within.).

As to claim 2, Walton shows maximizing a number N_1 of systematic bits in the first transmission packet (col. 6, lines 21-31; col. 7, lines 31-39; Table 1; shows that the demultiplexer demultiplexes the received modulation symbols into a number (N_T) of modulation symbol streams, one stream for each antenna used. In a case, where only one antenna is used, the modulation symbol stream contains all of the initial information bits where it is maximized into one stream.).

As to claim 3, the same rejection is used as in claim 2.

As to claim 4, Walton shows that M_1=M_2 and $N_1 \neq N_2$ (col. 7, lines 31-39, Table 1; shows the relationship between information bits and coded bits (modulation symbol stream). In a case where SNR range > 17.35, the information bits (N) per symbol is 5 and # of coded bits (M) per symbol is 6, once the modulation symbols are demultiplexed into a number of (N_T) modulation symbol streams, one stream for each for each antenna (i.e. 2 antennas) used, M and N (N is encoded in M as discussed above) are divided into two streams. $M_1 = M_2 = 6/2$, and $N_1 = 3$, $N_2 = 2$ (thus, $N_1 \neq N_2$) or the other way around.).

As to claim 7, Walton shows a step of encoding (212) a plurality of N systematic bits across time into an encoded packet of size M bits comprises interleaving (214) over the M bits (col. 10, lines 42-65).

As to claim 9, Walton shows a step of determining a quality of at least a first channel comprises determining a capacity of said first channel (col. 5, lines 3-8; Table 1, SNR column; col. 6, line 39 to col. 7, line 2).

As to claim 10, Walton shows a step of determining a quality of a second channel, and the values of M_1 and M_2 are determined from the quality of the first and second channels (col. 5, lines 3-8; Table 1, SNR column; col. 6, line 39 to col. 7, line 2).

As to claim 11, Walton shows a transmitter (110A) comprising: an encoder (212) having an input for receiving a plurality of N systematic bits and an output for outputting a plurality of M bits (col. 6, lines 21-30), wherein M is greater than N (col. 7, Table 1); a channel feedback circuit for determining a channel characteristic of a first communication channel (figures 1 and 2, CSI; col. 6 line 63 to col. 7, line 2); a demultiplexer having an input coupled to an output of the encoder and an input coupled to an output of the channel feedback circuit (Figures 1 and 2; 120, 120a), said demultiplexer for outputting in parallel a first portion M_1 of the M bits at a first output and

a second portion M_2 of the M bits at a second output (col. 7, lines 31-39; Table 1); a first amplifier coupled to said first output for increasing a power of said first portion M_1 of the M bits (Figures 1 and 2; modulator 122A; col. 7, lines 39-44); a first antenna coupled to the first output for transmitting said first portion M_1 of the M bits (Figure 1 and 2; 124A); and a second antenna coupled to the second output for transmitting said second portion M_2 of the M bits (Figure 1 and 2; 124T).

As to claim 12, Walton shows a second amplifier coupled to said second output for increasing a power of said second portion M_2 of the M bits (Figures 1 and 2; modulator 122A; col. 7, lines 39-44).

As to claim 20, Walton (and Walton et al. US 2002/0154705 A1 which is a reference incorporated; hereinafter Walton2.) shows a first subpacket selector (Walton2; combiner) having an input coupled to the first output of the demultiplexer, an input coupled to an output of the feedback circuit, and an output coupled to the first antenna (Walton2; figures 3, 4a-b, 5a-c), said first subpacket selector for selecting and combining, into a first transmission packet that is transmitted over the first channel, the first portion M_1 and at least one additional subpacket from the first output of the demultiplexer (Walton - Par. 0015, 0074, 0107, 0112), wherein a size of said first transmission packet is determined at least in part based on the output of channel feedback circuit (Walton - par. 0060, 0062-0073).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 5-6, 13-16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Walton et al (US 678341 B2; hereinafter Walton) in view of Catreux et al. (US 2005/0053170 A1; hereinafter Catreux).

As to claim 5, Walton shows a step of transmitting the first transmission packet from the first antenna over the first channel and from the second antenna over a second channel (Figure 1). However, Walton does not show a first power modified by a first weight value, and the first power modified by a second weight value.

Catreux shows that N RF signals are split MT ways by dividers 218 in order to form N(MT) RF signals. Theses N(MT) RF signals are each weighted using complex multipliers $226_{x,y}$ (Figure 2A; Par. 0035-0036). It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the transmitter of Walton to include the complex multipliers of Catreux as discussed above in order to optimize a performance measure of the multi-antenna communication system (Par. 0014).

As to claim 6, Walton shows a step of transmitting the second transmission packet from the second antenna over the second channel and from the first antenna over a first channel (Figure 1). However, Walton does not show a second power modified by a third weight value, and the second power modified by a fourth weight value.

Catreux shows that N RF signals are split MT ways by dividers 218 in order to form N(MT) RF signals. Theses N(MT) RF signals are each weighted using complex multipliers $226_{x,y}$ (Figure 2A; Par. 0035-0036). It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the transmitter of Walton to include the complex multipliers of Catreux as discussed above in order to optimize a performance measure of the multi-antenna communication system (Par. 0014).

As to claim 13, Walton shows all of the elements except a first eigenvector block in series with the first output, said first eigenvector block coupled to said first and said second antenna for applying a first power weight factor to said first portion M_1 of the M bits prior to transmission from said first antenna and for applying a second power weight factor to said first portion M_1 of the M bits prior to transmission from said second antenna.

Catreux shows that N RF signals are split MT ways by dividers 218 in order to form N(MT) RF signals. Theses N(MT) RF signals are each weighted using complex

multipliers $226_{x,y}$ (Figure 2A; Par. 0035-0036). It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the transmitter of Walton to include the complex multipliers of Catreux as discussed above in order to optimize a performance measure of the multi-antenna communication system (Par. 0014).

As to claim 14, Walton shows said first antenna transmitting over first channel and said second antenna transmitting over second channel (Figure 1). Walton does not show that first and second power weight factor are based on at least one of a size of said first M_1 and second M_2 portion and a channel quality of a first and second channel provided by channel feedback circuit.

Catreux shows that the weight calculation portion produces weight values based on channel state information and mode (Par. 0059). It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the transmitter of Walton by basing the weighting values based on channel state as discussed above by Catreux in order to optimize a performance measure such as signal-to-noise measure (SNR) or packet error rate (par. 0059).

As to claim 15, Walton shows all of the elements except a second eigenvector block in series with the second output, said second eigenvector block coupled to said first and said second antenna for applying a third weight factor to said second portion M_2 of the M bits prior to transmission from said second antenna and for applying a

fourth power weight factor to said second portion M_2 of the M bits prior to transmission from said first antenna.

Catreux shows that N RF signals are split MT ways by dividers 218 in order to form N(MT) RF signals. Theses N(MT) RF signals are each weighted using complex multipliers $226_{x,y}$ (Figure 2A; Par. 0035-0036). It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the transmitter of Walton to include the complex multipliers of Catreux as discussed above in order to optimize a performance measure of the multi-antenna communication system (Par. 0014).

As to claim 16, the same rejection is used as in claim 14.

Claims 8 and 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Walton et al (US 678341 B2; hereinafter Walton) in view of Salvi et al. (US 2004/0139383 A1; hereinafter Salvi).

As to claim 8, Walton shows all of the elements except that encoding further comprises turbo encoding using a single turbo interleaver of size N prior to interleaving over the M bits.

Salvi shows at Par. 0040, that interleaver 214 is within encoder 200. Entire packet of code bits (input with size N – number of bits) are stored in interleaver 214. It would have been obvious to one of ordinary skill in the art at the time of the invention to

modify the encoder of Walton to include the interleaver of Salvi in order to reduce the processing delays since data can be written to and read from the interleaver in a fraction of time (par. 0043).

As to claim 17, Walton shows a channel interleaver of length M having an input coupled to the output of the encoder (Figure 2; col. 6, lines 27-29; Channel Interleaver 214 which receives coded bits from encoder 212.). Walton does not show an interleaver of length N.

Salvi shows at Par. 0040, that interleaver 214 is within encoder 200. Entire packet of code bits (input with size N – number of bits) are stored in interleaver 214. It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the encoder of Walton to include the interleaver of Salvi in order to reduce the processing delays since data can be written to and read from the interleaver in a fraction of time (par. 0043).

Claims 18 and 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Walton et al (US 678341 B2; hereinafter Walton).

As to claim 18, Walton does not explicitly show that the first M_1 and second M_2 portion are the same size and the systematic bits are not equally distributed among the first M_1 and second M_2 portion. However, Walton shows that demultiplexer 222

receives N_c modulation symbol from N_c channel data processors and demultiplexes the received modulation symbols into a number of (N_T) modulation symbol streams, one stream for each antenna used to transmit the modulation symbols (col. 7, lines 31-40). In an example where there exist two antennas, the initial modulation symbol is demultiplexed into two modulation symbol streams. Also, as shown in col. 7, lines 30-40 and Table 1, the information bits that was initially provided as input is encoded into modulation symbols after it goes through the TX data processor then provided to the TX MIMO processor (where the demultiplexer is located), the systematic bits are not necessarily equally distributed among the two M portions. It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the transmitter of Walton by explicitly having the functions of the demultiplexer as discussed above in order to efficiently transfer multiple streams of data.

As to claim 19, Walton does not explicitly that the demultiplexer operates to maximize a number of systematic bits in the first portion M_1. The examiner interprets this claim limitation as being the same as when a transmitter is functioning using only 1 transmit antenna. Since, the systematic bits are maximized in the first portion M_1, there is not data coming out of the second output of demultiplexer (no second portion M_2). Therefore, there is not second data portion that passes through the second amplifier and second eigenvector block and finally, there is no transmission on the second antenna. While the above interpretation was used, the same rejection is used as in claim 18 where the N_T (number of stream) is 1.

Claims 21-23 is rejected under 35 U.S.C. 103(a) as being unpatentable over Walton et al (US 678341 B2; hereinafter Walton) in view of Ling et al. (US 6961388 B2; hereinafter Ling).

As to claim 21, Walton shows a method for transmitting a digital message (abstract) comprising: encoding (212) a plurality of input bits; based on a determined characteristic of at least a first channel (col. 6, lines 21-30). Walton does not show a step of adaptively splitting the encoded input bits into a first subpacket defining a first subpacket size and a second subpacket defining a second subpacket size; and transmitting the first subpacket at a first rate over the first channel and the second subpacket at a second rate over a second channel.

Ling shows a step of adaptively splitting the encoded input bits into a first subpacket defining a first subpacket size and a second subpacket defining a second subpacket size; and transmitting the first subpacket at a first rate over the first channel and the second subpacket at a second rate over a second channel (Figures 1, 4A, 4B). It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the method of Walton by having the packet splitting of Ling as discussed above in order to have the capability of transmitting on a number of spatial subchannels for each frequency subchannel (col. 2, lines 46-49).

As to claim 22, Walton shows a transmitter (110, 110a) comprising: an encoder (212) to encode a plurality of input bits; a demultiplexer (222), having an input coupled to an output of the encoder to adaptively split the encoded plurality of bits into a first subpacket and a second subpacket; a first antenna coupled to an output of the demultiplexer, to transmit the first subpacket at a first rate over a first channel (124A); and a second antenna coupled to an output of the demultiplexer, to transmit the second subpacket at a second rate over a second channel (124T). However, Walton does not show defining a first subpacket size and a second subpacket size.

Ling shows a step of defining a first subpacket size and a second subpacket size. (Figure 4B). It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the method of Walton by having the packet splitting of Ling as discussed above in order to properly split a packet into subpackets for transmission on different channels.

As to claim 23, modified Walton shows a channel feedback circuit, having an output coupled to an input of the demultiplexer, to provide a channel characteristic of at least the first channel by which the demultiplexer adaptively splits the encoded plurality of bits (Figure 1-3, CSI; col. 6, line 63 to col. 7, line 2; col. 7, lines 31-39; Table 1).

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Kenney et al. (US 6771705 B1) – note abstract;

Chen et al. (US 7024611 B2) – note abstract;

Giannakis et al. (US 2004/0202256 A1) – note abstract.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Redentor M. Pasia whose telephone number is 571-272-9745. The examiner can normally be reached on M-F 7:30am to 5:00pm EST, alternating Fridays off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Doris H. To can be reached on (571)272-7629. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Redentor Pasia

DORIS H. TO
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2600